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CLAIMS

1. A communication system for down hole use and comprising a drill collar (101) comprising a first portion (103) and a second portion (105) separated from each other by an electrically insulating material (67) and means (22, 63, 77, 81) for generating an electrical signal and for applying the electrical signal to the drill collar (101) such that the electrical signal is transmitted into a geological formation being drilled, characterised in that the means for generating the electrical signal comprises an alternator (22, 63, 77, 81) and means (2, 4, 10) mechanically connected to the alternator, the means (2, 4, 10) being responsive to an electrical output of the alternator for regulating rotation of the alternator.

2. A communication system as claimed in claim 1, characterised in that the means responsive to the electrical output of the alternator comprises a torque generating apparatus (2, 4, 10) which generates torque in response to the electrical output of the alternator and transmits such torque to the alternator for regulating rotation thereof.

3. A communication system as claimed in claim 2, characterised in that the torque generating apparatus comprises a first assembly (10, 25) including a generally cylindrical member of magnetically soft material and having a longitudinal axis, a second assembly (2) arranged coaxially within the first assembly and including an electromagnetic winding (4), the first assembly and the second assembly being rotatable relative to each other about the axis, the arrangement being such that relative rotation between the first and second assemblies induces a magnetic field which generates rotational torque between the first and second assemblies.

4. A communication system as claimed in claim 3, characterised in that the first assembly is a rotor assembly (10, 25) of the torque generating apparatus for producing rotational torque and the second assembly (2) is a stator assembly of the torque generating apparatus.

5. A communication system as claimed in claim 3 or 4, characterised in that rectification means (31) is provided to convert the electrical output from the alternator to provide D.C. current to the electromagnetic winding (4) of the torque generating apparatus to generate an electromagnetic braking effect.

6. A communication system as claimed in claim 5, characterised in that the electrical output of the alternator (22, 63, 77, 81) is connected indirectly to the electromagnetic winding (4) of the torque generating apparatus by way of alternator voltage regulation means to create the electromagnetic braking effect.

7. A communication system as claimed in claim 6 characterised in that the alternator voltage regulation means functions to provide a progressive braking effect.

8. A communication system as claimed in claim 6 characterised in that the alternator voltage regulation means functions to effect braking at a predetermined set point.

9. A communication system as claimed in any preceding claim, characterised in that the regulated rotation of the alternator speed produces a substantially constant output voltage signal from the alternator.

10. A communication system as claimed in any preceding claim, characterised in that the regulated rotation of the

alternator produces a substantially constant output frequency signal from the alternator.

11. A communication system as claimed in any preceding claim, characterised in that at least one switch (75, 79, 83, 85) is provided for applying the electrical signal to the drill collar (101).

12. A communication system as claimed in claim 11 characterised in that the at least one switch comprises a semiconductor switch.

13. A communication system as claimed in claim 11 characterised in that the at least one switch comprises an electromechanical switch.

14. A communication system as claimed in any one of claims 11, 12 or 13, characterised in that a microprocessor (69) is provided to control the at least one switch.

15. A communication system as claimed in any preceding claim, characterised in that the electrical signal comprises coding means to transmit data to receiving means at a region outside the geological formation.

16. A communication system as claimed in claim 15, characterised in that the coding means is selected from Amplitude Shift Keying, Frequency Shift Keying, Pulse Position Modulation and/or Phase Shift Keying.

17. A communication system as claimed in claim 15 or 16, characterised in that the receiving means comprises at least one amplifier.

18. A communication system as claimed in claims 15, 16 or 17, characterised in that the receiving means comprises timing means.

19. A communication system as claimed in any one of claims 15 to 18, characterised in that the receiving means comprises at least one microprocessor.

20. A communication system as claimed in any preceding claim, characterised in that the communication system comprises at least one transformer (93) such that the impedance of the electrical signal can be altered.